SURFACE WATER MONITORING

James L. Plafkin
U.S. Environmental Protection Agency,
Monitoring and Data Support Division,
Office of Water, 401 M Street S.W.,
Washington, D.C. 20460.

Introduction

Surface Water Monitoring

After focusing on technology-based water pollution controls for well over a decade, Federal and State agencies are shifting the emphasis to water quality-based approaches for solving the remaining (post-BAT) problems. As highlighted in the 1987 Water Quality Act (WQA 1987), assessments of ambient conditions (e.g., Sections 305(b), 304(1), 314 and 319) should play an important role in implementing these approaches. Ambient data are needed to identify problem waterbodies, set management priorities, develop water quality-based controls, and document the effectiveness of these controls. However, as pointed out in EPA's recent report, "Surface Water Monitoring a Framework for Change" (USEPA 1987), it is unlikely that existing monitoring programs will be able to fulfill these data needs.

Changing Needs

There are solid facts supporting this prediction. One is that the list of potentially important pollutants has expanded tremendously in the last decade. Many of these pollutants are toxic substances that can cause deleterious effects at levels that are very difficult to detect in the ambient environment. Others, e.g. fine sediment loadings and habitat loss, defy traditional toxicological characterization and measurement. Furthermore, the impact of these stress agents is not simply dependent upon exposure concentration. Duration and frequency of exposures and the influence of site-specific water quality factors are also important. These factors interact in a continually varying environment to profoundly influence the actual expression of effect. It is this need to characterize the actual as well as the predicted effect of pollutants that poses the greatest challenge to existing monitoring programs.

Traditional programs have focused almost entirely on analysis of water column chemistry using a mix of fixed station and intensive survey monitoring. Fixed stations supposedly provide the broad geographical coverage needed to screen for emerging water quality problems and characterize general trends. Intensive surveys, on the other hand, supply the more detailed information needed to diagnose the causes of specific problems and develop appropriate controls. And when conventional pollutants (e.g., BOD, TSS, pH) emanating from point sources are the principle concern, these programs can work quite well. However, the bewildering array of pollutants and their complex chemical behavior instream, coupled with the sheer expense of analyzing for them, makes routine monitoring

for all but a few of them infeasible. Therefore, analytical resources must be effectively targeted on waterbodies where real problems, not merely predicted problems, actually exist.

Bioassessments

Bioassessments can help. Such assessments measure the direct responses of instream organisms exposed to environmental pollutants rather than just the exposures. The rationale behind this approach is that the resident organisms (communities, populations, or individuals) naturally integrate variable exposures and complex stresses, and are therefore the best overall indicators of aquatic life impact. Biosurveys, for example, provide the most general measure of ecological integrity (water quality and habitat). They can be used to guide planning and management decisions, inventory aquatic resources, describe attainable aquatic life goals, screen and prioritize problem areas, characterize trends, and document the "bottom line" results of control actions. Bioassays, on the other hand, integrate across pollutants and are used more specifically i.e., to discriminate generic toxicity from other types of impacts; and to help interpret narrative "free from" criteria. Finally, tissue residue analyses can be used to identify specific pollutants with concentrations that are either too low or too variable to detect in the ambient medium. All of these tools will be needed to meet the ever increasing demand for meaningful, but economical, monitoring data.

Implementation Issues

Despite the conceptual appeal of broadening the use of bioassessment approaches in water monitoring programs, several practical issues regarding implementation still need to be considered before bioassessments can be effectively implemented on a national scale.

o Biocriteria
  - Do biocriteria necessarily have to be incorporated into water quality standards?

  - Do they have to be quantitative and numerical to be useful?

  - Given an "average" ecoregion, how many and what kinds of evaluations are needed to confirm its boundaries and establish biocriteria? How long does it take and how much does it cost?

  - Are different criteria needed for different types of water bodies; designated uses; different subcommunities; different geographical (e.g., subregional, local) scales; different temporal scales (seasons)?

o Monitoring biocriteria and performing assessments

  - Would methods used to assess criteria differ from those used to develop criteria? If so, why?

  - Should any nonbiological parameters be routinely monitored in conjunction with a bioassessment?

- What is the role of biocriteria in assessing toxics? Habitat degradation?

These are only a few of the issues that will need to be considered before bioassessments can be effectively implemented on a national scale.

Literature Cited

U.S. Environmental Protection Agency. 1987. Surface Water Monitoring: A Framework for Change. U.S. Environmental Protection Agency, Office of Water and Office of Planning and Procedure, Washington, D.C.

Water Quality Act. 1987. Ammendment to the Clean Water Act. Public Law 92-500.